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ABSTRACT

The use of funding/allocation formulas in public higher education and the efficacy of Higher Education General Information Survey (HEGIS) taxonomies as the basis for discipline cost differentials in Tennessee are examined. Major criteria on which funding/allocation formulas should be based and weaknesses in existing formulas are also identified. Attention is focused on funding formulas employed in the Southern Regional Education Board states, including student credit hours or full-time equivalence, workload factors, costs, student level, discipline, method of instruction, and type of institution. Data from a 1981 Tennessee Cost Study were used to test the efficacy of using HEGIS taxonomies in budget formulas. Each class or department was identified as a cost center from which instructional costs were derived by HEGIS taxonomy and level. It is sggested thgt ideally formulas should be based on standardized workload measures that reflect the resource requirements for the attainment or maintenance of the level of quality specified in institutional missions. It is concluded that the HEGIS taxonomies were not designed for measurement of costs or workloads and are inappropriate bases for this purpose. Data from the 1981 Tennessee Cost Study are included. (SW)

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FUNDING AND BULGETING FORMULAS AND THE AVAILABILITY AND ALLOCATION OF RESOURCES TO PUBLIC UNIVERSITIES

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I

Even a cursory examination of the traditional economics journals will reveal that surprisingly little attention has been given by economists to the provision and allocation of resources in the higher education industry. Most of the efforts by economists seems to have been expended in analyzing the outputs of higher education, chiefly as the creation of human capital and knowledge. However, the underlying production functions and their attendant costs seem to have seen largely ignored in "mainstream" economics. The bulk of the research in this area has been conducted by the institutional research and planning offices of individual universities,[1] staffs of governing boards,[1] state education and budgeting offices, departments of higher education administration of colleges of education, the National Center for Higher Education Management Systems, the Ford Foundation Program for Research in University Administration (located at the University of California), and various "commissions" funded by the Carnegie Foundation.

Any attempt to deal with all aspects of the higher education production function and its implications for funding/allocation formulas

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[1]Based on the author's personal experience very few of the professional staffs of institutions and governing boards have any significant training in economics.

is obviously beyond the scope of this paper. Thus it is necessary to delineate a few aspects which are of importance and deal with these. Specifically this paper will: (1) outline the general characteristics of the funding/allocation formulas which are or have been in use as these relate to instruction; (2) identify some major criteria on which funding/allocation formulas should be based and relate these criteria to weaknesses in existing formulas; and (3) analyze the efficacy of the HEGIS taxonomies[2] as the basis for discipline cost differentials using "cost study" information from public community colleges and universities in Tennessee.

In approaching the subject I will not make a significant distinction between funding and allocation formulas, although the funding and allocation decision processes may be separated and may take the following forms or combinations thereof: (1) legislative budget requests based on formulas; (2) allocation among institutions by the legislative body based on the formula; (3) allocation of the legislative appropriations among institutions by governing boards using the formula or modifications which the boards may have the authority to make; and (4) internal allocation of funds within institutions based on legislative intent, governing board directions and internal formulas. In some cases the

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[2]Higher Education General Information Survey (HEGIS). The taxonomies are subject matter classifications which are identified in A Taxonomy of Instructional Programs in Higher Education. Washington: National Center for Educational Statistics, 1970. These taxonomies have been revised in A Classification of Instructional Programs. Washington: National Center for Educational Statistics, 1981. I have not been able to determine that the new classifications are in use in budget formulas. In fact, the new classifications are so detailed and complicated that few, if any, institutions have the data base and accounting systems which would allow implementation in the budgeting/resource allocation process.

institutions' freedom to make internal allocations among programs may be severely restricted.[3] To the best of the author's knowledge only one state (Tennessee) allows institutions to carry funds forward from one fiscal year and re-program these funds in subsequent years.

II

The funding/budgeting formulas which are in use are traditionally divided into the functional areas within the educational and general budget. These functional areas are: Instruction (including departmental research); Academic Support (including libraries); Organized Research; Public Service; Student Services; Physical Plant Operation and Maintenance; and Institutional Support.[4]

The extent to which funding/budgeting formulas are used in public higher education tends to vary on a year to year basis.[5] However, among the regions in the United States the use of such formulas is concentrated in the South, where in 1978, twelve of the fourteen states in the

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[3]As used here "programs" are defined as Instruction, Research Public Service, Academic Support, Student Service, Institutional Administration, Physical Plant Operations, Student Financial Support, and Independent Operations. See Program Classification Structure, 2nd ed., Technical Report 106, National Center for Higher Education Management Systems, 1978. Other terms used in practice may include "budget functions," "tasks," etc.

[4]A more satisfactory classification of functions (programs) is identified in footnote #3.

[5]Gross reports that 22 states used in budget formulas in 1977 which was down from 25 states in 1973. F. M. Gross, "Formula Budgeting and the Financing of Public Higher Education: Panacea or Nemesis for the 1980's?" The AIR Professional File, No. 3, Association for Institutional Research, Fall, 1979, p. 3. Gross makes the interesting point that among the 43 institutions identified in the 1979 Ladd/Lipsett Survey as having top-ranked faculties in 19 fields, only six in 5 states were subject to formula funding (a total of 19 fields for which the University of Wisconsin/Madison accounted for 12 fields). Eighteen state universities in non-formula states accounted for 72 top-ranked departments. Ibid, p. 3.

Table 1

General Characteristics of Formulas Employed in the Southern Regional Education Board States for the Instructional Function, 1977*

Formula Characteristic	State											
	Ala.	Ark.	Fla.	Georgia	Kentucky	Louisiana	Maryland	Miss.	So. Car.	Tenn.	Texas	Vir.
Use Student Credit Hours or full-time equivalent	X	X	X	X	X	X	X	X	X	X	X	X
Use workload factor	–	X	X	X	X	–	–	–	X	–	–	X
Use costs	X	–	–	–	–	X	X	X	–	X	X	–
Use level of student	X-3+	X-6+	X-4a,+	X-3b,+	X-6+	X-5+	X-4+	X-3+	X-3+	X-4+	X-5+	X-4+
Use disciplines	X-15+	-	X-5a,+	X-5b,+	X-2+	X-9+	-	X-25+	X-22+	X-30+	X-19+	X-14+
Use method of instruction	X-2+	-	-	-	-	-	-	X-3+	X-3+	-	-	-
Use type of Institution	-	-	-	-	-	-	X-3+	-	-	-	-	-

*As modified by the author's knowledge of changes made since 1977.

X Indicates use

+ Indicates number used

[a] Educational and General Allocation, 1982-83, The State University System of Florida, Tallahassee, Florida, p. i.

[b] Formula for Excellence: Financing Georgia's University System in the '80s, Final Report of a Study Committee on Public Higher Education Finance, Office of the Governor, Altanta, Georgia, September, 1982, p. 23.

Source: Adapted from David S. Spence, Formula Funding in the SREB States, Southern Regional Education Board, 1978.

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Southern Educational Board region employed formulas.[6] Because the information which is most readily available is for these southern states, the analysis in this paper will concentrate on the formulas employed in the South.[7]

The general characteristics of the instruction component of the funding/budget formulas which have been/or are employed in the SREB states include: (1) the implicit assumption that instructional costs or resource requirements are linear; (2) use of student credit hours (SCH) or full-time equivalent students (FTE) as the driving element; (3) either workload factors (physical inputs) or costs as a measure of the requirements; (4) differentials among student credit hours by level and discipline, or by method of instruction; and (5) limited use of factors which differentiate among types of institutions (see Table 1). One half of the formulas employ workload factors and the other half use costs. The number of levels used to classify SCH or FTE students varies from three to six and the number of disciplines from 2 to 30.[8] Only three states have employed elements which differentiate by type of institution and only one state (Maryland) uses methodology of instruction in lieu of disciplines.

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[6]David S. Spence, Formula Funding in the SREB States, Southern Regional Education Board, 1978, p. 13.

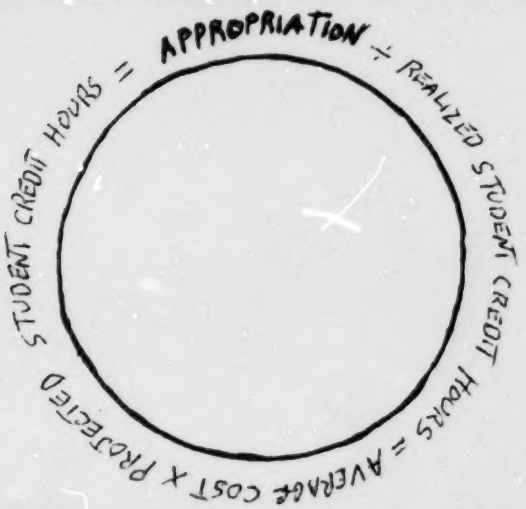
[7]These can be only a limited number of variants on the "theme" and thus most of what will be said here will be applicable to the formulas employed in other states. The formulas may also be changed from time to time, or their use suspended because of financial exegencies. The author has noted a tendency to modify the "zero base" concept when its continuation would result in significant reductions or substantial re-allocation of resources among institutions.

[8]Some variation in the number of levels of instruction results from the inclusion, or exclusion, of medicine, dentistry, and veteranarian medicine in the formula. The general practice is that appropriations for these fields are not determined by formula.

One of the basic problems in the formula arises from the use of historically based costs or workload measures, as opposed to estimated current costs or standardized workload measures.[9] The use of historical costs or workload measures introduces a circularity into the budget process which may result in a self-fulfilling prophecy syndrome (see Chart 1).

Chart I

Circularity in Historical Cost Driven Formulas



The general impacts of formulas using historical costs/workload measures may be summarized as follows: (1) reductions in appropriation for reasons other than reduced enrollments reduce average costs (or increase workload measures); (2) increases in enrollments lower average costs and vice versa; (3) unanticipated increases in enrollment are not

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[9]This is not the case in the Physical Plant and Maintenance components of the formulas where estimates of utility costs may be included and workload measures tend to be in terms of ratios to square footage. David S. Spence, Ibid, pp. 20 and 21.

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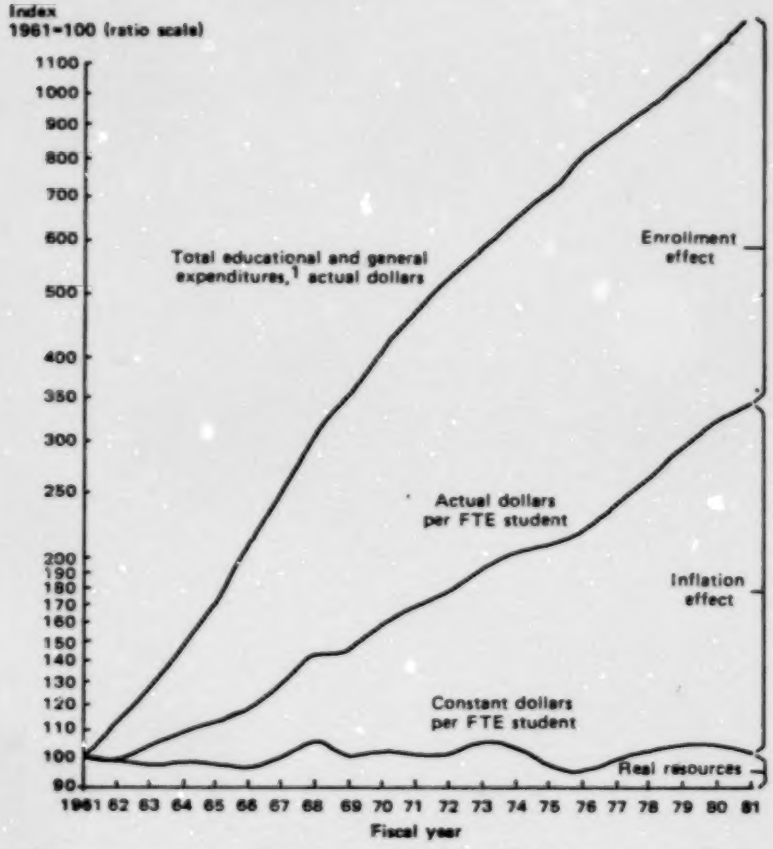
funded at all in the first year and resources are provided at a reduced rate thereafter. Unexpected decreases in enrollments result in "over funding" in the first year and are deducted at a higher average cost thereafter; and (4) inflation is not reflected in costs. Formulas based on historical costs can be "fully funded" while the availability of resources to institutions is being reduced, if full allowances are not made for inflation in the services and commodities which universities purchase. In fact, such effects are not even readily apparent to those who made the appropriations. If the formulas are not "fully funded" the positions of the institution deteriorate even more rapidly. Data on expenditures in all public institutions indicates that no new real resources have been made available to these universities on a per student basis over the period 1961-1981 (see Chart 2). Unfortunately, a comparison of public universities subject to a historical cost driven formula to those which are not cannot be readily made. However, I strongly suspect those on a historical cost formula have not faired as well as the remainder of the public institutions; (5) shifts in students among discipline change relative discipline costs but not overall average costs; and (6) as mentioned previously, the measures of costs employed are rough. Few institutions or systems have the necessary accounting systems and data bases in place for the measurement of expenditures down to the class and student credit hour levels.

The historically based average costs or workload measures are derived across institutions which vary widely in size, complexity, priorities, and missions. Such practices assume that the instruction

Chart 2

INDEXES OF CURRENT FUND EDUCATIONAL AND GENERAL EXPENDITURES[1]
IN PUBLIC INSTITUTIONS OF HIGHER EDUCATION IN THE UNITED STATES,
1961 - 1981



[1]Excludes expenditures for sponsored research, student financial aid, and mandatory transfers.

Source: D. Kent Halstead, Inflation Measures for Schools and Colleges, Washington: U.S. Government Printing Office, 1983, p. 46.

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production function is homogeneous, of degree one.[10] In addition the large institutions dominate the averages, and inherent economies of scale, institutional priorities and missions distort the allocation of resources to the smaller, and perhaps more general purpose universities.[11]

III

The search for an ideal funding formula might be likened to the pursuit of the Fountain of Youth--it has never been found nor does it exist. While recognizing that there is not a formula which is ideal for all applications, models can be developed which are more useful and equitable than the ones currently in use.

A detailed examination of the funding formulas employed in higher education and their underlying bases will reveal a patchwork of factors and objectives. In addition, a survey of legislative appropriation bills and statements of intent will reveal a number of non-formula "turkeys" which have been appended and continued without review. The purpose here is to identify the major attributes of a funding formula which will allow for an unambiguous statement of requirements, and which will permit explicit understanding of the impact of legislative appropriations

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[10] Such an assumption is not always made for the other budget functions. For example, in the General Administration and Student Services categories, seven of the SREB states take into account the economies of scale by adjusting the appropriations by decreasing dollar rates with the level of student enrollment or decreasing the percentage appropriated by size and type of institution. David S. Spence, Ibid, pp. 16 and 17.

[11] I once demonstrated that a change in priorities of the magnitude experienced in the post-Sputnik era by the University of Florida would reduce the faculty resources made available to the smallest institution of the State University System of Florida approximately 2 percent, see Roy L. Lassiter, Jr., Institutional Productivity and the Utilization of Faculty Resources in the State University System of Florida, Gainesville: Institute of Higher Education, June, 1976, pp. 79-84.

decisions and other exogenous factors. The following is an enumeration of these attributes with brief comments about their characteristics.

1. The funding formula should be based on the concept of standards, i.e., the levels of funding within which quality programs can be achieved and maintained. Such bases will permit assessment of the explicit impact of appropriation/allocation decisions and inflation on programs. In some elements of some formulas, this has been at least partially achieved. For example, application of the "Washington Formula" to establish library collection requirements, or of plant operation and maintenance standards based on square footage and type and age of buildings have been used to develop these elements of the budget. Unfortunately, relatively little application has been made of standards in the instruction area.[12] When elements of the formula are expressed in terms of the desired relationships between inputs and outputs, as opposed to historical costs or rates, the budget requests can be expressed in terms of current dollar costs and the effects of reductions in appropriations or inflation above current costs are readily apparent. Furthermore, the use of historical data "builds in" past priority decisions and underfunding, and the lags inherent in a historical base.

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[12]For a number of years Florida was on such a standard in terms of set ratios of student credit hours to FTE faculty positions (see A. J. Brumbaugh and Myron R. Blee, High Education and Florida's Future, Gainesville: University of Florida Press, Vol. 1, 1953). The press of enrollments, other demands on state funds, and the discovery by legislators that considerable savings could be realized by forcing higher "productivity" led to the abandonment of these standards. In the middle 1970s, I participated as a member of the System Planning-Programming-Budgeting Committee in the same state to develop ratios within which quality could be achieved. The efforts involved faculty and administrators and an agreed upon set of ratios were developed. The recommendations were implemented only for new enrollments, apparently because employment of the ratios on a zero-based budget would result in a substantial reallocation of resources from the older institutions to the newer ones, and would greatly increase the appropriations request.

2. The formula should reflect economies of scale, complementarity among programs, the joint production processes inherent in higher education, and the concept of a "critical mass" to support programs. As suggested earlier, the concept of economies of scale has been built in to some formulas in the Student Services and General Administration areas.[13] Funding/budgeting formulas appear to be little affected by what is known about production processes in higher education, and much remains to be documented about the nature of these processes.

3. The formula should be as simple as is possible, at least in concept. Furthermore, the whole budgeting procedure should provide economic incentives rather than disincentives. Institutions which achieve efficiency in their operations should be allowed to keep at least part of savings which may result from efficiencies.

4. The formula should provide for some stability in funding. Resources, particularly faculty resources, cannot be rapidly shifted among programs or rapidly reduced. One desirable procedure would be to reduce the allocation to an institution facing decreasing enrollments only if the appropriation would result in greater funding than the formula would

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[13] Perhaps the most comprehensive study of the production functions in higher education is that of Carlson (see Daryl E. Carlson, The Production and Cost Behavior of Higher Education Institutions, Berkeley: Ford Foundation for Research in University Administration, 1972), Carlson showed that (1) there were significant economies of scale at least up through institutions of moderate size; (2) there were joint production relationships between instruction, research, and public service; (3) average and marginal productivities and the resulting average and marginal costs are affected by quality, scale, program mix, number of fields, etc.; and (4) there are cost reducing effects of a high proportion of graduate enrollments on an increase in undergraduate enrollments. Ibid, pp. 39, 74, 84, 149, 167, 169 and 170.

provide if it were fully funded. In any event, reductions should be on a marginal, rather than an average cost basis.[14]

5. Any formula employed should be flexible enough to allow for distinctive institutional missions and characteristics.

6. The formula should be founded on an adequate data base, with precise definition of terms, and with cross-walk capability among systems.

7. The formula should be recognized for what it is; the mechanism for appropriations allocations. "Accountability" is to be measured in terms of institutional missions and priorities not by the mechanical elements of the formula.

IV

As indicated in the introduction to this paper, one of the objectives is to test the utility of the HEGIS taxonomies as either cost centers or the bases for workload measures. As one examines the taxonomies it is surprising that they have been employed extensively in formulas. They were intended to be classifications of student programs, but in practice have also been used for academic disciplines and cost centers.[15] Furthermore, in the major subdivisions (two digit level) inexplicable groupings or lack thereof occur. For example, psychology is identified as a major "discipline" while the physical sciences and the

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[14] In many cases, increasing enrollments in the past have been funded at less than full average cost. It certainly would not be appropriate to deduct full costs when enrollments decline.

[15] See Robert A. Huff and Marjorie O. Chandler, Ibid. A listing of the taxonomies is provided in this document and also in Douglas J. Collier, Ibid.

social sciences are each "compressed" into single groups (with appropriate subdivisions).

In spite of these weaknesses, the taxonomies have been and are being employed in budget formulas. The purpose here is to test the efficacy of such employment. The data utilized comprise the 1981 Cost Study of the Tennessee Higher Education Commission for nine public universities and ten public community colleges in the state.[16] Each class or department is identified as a cost center from which instructional costs are derived by HEGIS taxonomy and level.[17] The term "cost study" is something of a misnomer in that budgeted amounts are allocated to the

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[16]A description of the Cost Study and the methodology employed is continued in An Analysis of Instructional Cost. Nashville: Tennessee Higher Education Commission, Fall Quarter, 1981. The institutions are: Austin Peay State University; East Tennessee State University; Memphis State University; Middle Tennessee State University; Tennessee State University; Tennessee Technological University; University of Tennessee - Chattanooga; University of Tennessee - Knoxville; University of Tennessee - Martin; Chattanooga State Technical Community College; Cleveland State Community College; Columbia State Community College; Dyersburg State Community College; Jackson State Community College; Motlow State Community College; Roane State Community College; Shelby State Community College; Volunteer State Community College; and Walters State Community College.

[17]The "disciplines" used in this study include (with their two digit designators): Agriculture and Natural Resources (01); Biological Sciences (03); Business and Management (05); Communications (06); Computer Sciences (07); Education (08); Engineering (09); Fine Arts (10); Foreign Languages (11); Health Professions (12); Home Economics (13); Letters (14); Library Science (16); Mathematics (17); Physical Sciences (19); Psychology (20); Public Affairs and Services (21); Social Sciences (22); and Interdisciplinary Studies (40). Architecture (02), Law (14), and Area Studies (03) were excluded because these programs were offered at only one or two of the institutions. Military Science (18) was excluded because the Department of Defense bears a substantial portion of the instructional cost. The technical/terminal programs of the community colleges were not included because there are no counterparts at the universities. The levels employed are: Level One - freshmen and sophomore classes; Level Two - junior and senior courses; Level Three - masters level courses; and Level Four - doctoral level courses.

"cost center" rather than the actual expenditures.[18] Without going into great detail, the procedure employed in the cost study in Tennessee is to allocate instructors' salaries, academic administration, institutional services, other professional services, and clerical and supporting salaries to classes offered. Academic advising, thesis and dissertation supervision, and departmental research are allocated to academic departments (budget units). These costs are allocated on a linear basis and then converted to costs for student credit hour. The procedure employed in the analysis here is to allocate all costs to classes in order to have only single cost centers. The overall results in costs per student credit hour are essentially the same using either method.

The cost study is based on 22,256 classes offered by nine public universities and 3,695 classes offered by the 10 public community colleges. Of the university classes, 44 percent were at Level One, 33 percent at Level Two, 20 percent at Level Three, and 3 percent at Level Four (see Table 2). When the costs are converted to a student credit hour basis, there are substantial variations in costs among the institutions for given disciplines and levels, and among the disciplines (see Tables 3 and 4). The significant overlapping of the ranges of costs among the disciplines and the substantial coefficients of variations for mean costs are consistent with the findings elsewhere.[19]

The first step in the analysis of the cost data involved testing the hypothesis that mean instructional costs for the HEGIS disciplines

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[18]This is the case for most "cost studies" in higher education. An analysis of expenditures would require: (1) a uniform chart of accounts among institutions; (2) a common course identification system; (3) internal accounting systems designed to discover detailed costs at the course level; and (4) a comprehensive system of accounting for faculty time.

[19]See, for example, Roy L. Lassiter, Jr., Ibid., pp. 44-48.

Table 2

NUMBER OF CLASSES OFFERED BY NINE PUBLIC UNIVERSITIES IN TENNESSEE, BY LEVEL AND DISCIPLINE, FALL 1981

Discipline	Level and Number of Classes			
	Level One	Level Two	Level Three	Level Four
Agriculture	107	248	165	28
Biol. Sciences	957	428	306	74
Bus. & Mgmt.	570	1,113	425	48
Communications	115	240	59	6
Comp. Science	214	124	96	1
Education	1,224	1,370	1,087	216
Engineering	422	801	445	66
Fine Arts	945	693	306	6
For. Languages	299	100	53	8
Health Prof.	30	320	159	25
Home Economics	168	215	91	31
Letters	1,545	270	153	22
Lib. Science	-	28	52	-
Mathematics	827	113	89	22
Physical Sci.	1,169	319	178	46
Psycology	183	250	230	71
Pub. Affairs	81	212	160	-
Social Sciences	877	502	297	43
Interdisc.	54	42	12	6
TOTAL	9,787	7,388	4,363	718

Source: Computed from data in the 1981 cost study of the Tennessee Higher Education Commission.

Table 3

INSTRUCTIONAL COST PER STUDENT CREDIT HOUR STANDARD DEVIATION OF COST, AND COEFFICIENT OF VARIATION FOR NINE PUBLIC UNIVERSITIES IN TENNESSEE LEVEL AND DISCIPLINE, FALL 1981*

HEGIS Discipline	Level One $\bar{X}$	Level One σ	Level One C.V(%)	Level Two $\bar{X}$	Level Two σ	Level Two C.V.(%)	Level Three $\bar{X}$	Level Three σ	Level Three C.V.	Level Four $\bar{X}$	Level Four σ	Level Four C.V.
Agriculture	$32.79	13.79	42.06	$43.85	37.29	85.04						
Biol. Sciences	26.27	14.62	55.65	45.54	49.46	108.61	(Not yet available)			(Not yet available)		
Bus. & Mgmt.	19.20	10.25	53.39	25.41	22.10	86.97						
Communications	26.35	19.46	73.85	34.06	25.26	74.16						
Comp. Science	23.95	13.42	56.03	36.17	33.46	92.51						
Education	29.37	19.58	66.67	43.77	34.65	79.16						
Engineering	31.19	23.16	74.25	54.06	38.47	71.16						
Fine Arts	45.24	53.16	117.51	63.66	74.86	117.59						
For. Languages	32.59	31.25	95.89	67.93	69.82	102.78						
Health Prof.	42.85	21.07	49.17	55.06	47.45	86.18						
Home Economics	30.81	22.95	74.49	44.50	42.33	95.12						
Letters	21.50	11.26	52.37	34.47	44.15	128.08						
Library Sci.	-	-	-	55.99	26.31	46.99						
Mathematics	18.64	9.07	48.66	35.79	41.40	115.67						
Physical Sci.	27.87	20.48	73.48	53.85	64.53	119.83						
Psychology	13.93	10.02	71.93	29.00	32.07	110.59						
Public Affairs	29.02	22.97	79.15	40.75	33.83	83.02						
Social Sciences	20.06	12.73	63.46	35.02	35.18	100.46						
Interdisc.	37.11	25.92	69.85	93.13	70.83	76.05						

*Preliminary

Source: Computed from data in the 1981 cost study of the Tennessee Higher Education Commission.

Table 4

RANGE IN TOTAL INSTRUCTIONAL COST PER STUDENT CREDIT HOUR AMONG NINE PUBLIC UNIVERSITIES IN TENNESSEE BY LEVEL AND DISCIPLINE, FALL 1981*

	Level and Range of Mean Instructional Cost			
Discipline	Level One	Level Two	Level Three	Level Four
Agriculture	$18.88-54.92	$36.59-85.21	$47.76-116.83	225.12[b]
Biol. Sciences	18.15-45.90	33.54-52.20	43.51-184.78	172.35-233.88[a]
Bus. & Mgmt.	14.17-28.69	19.81-33.94	38.07-171.85	183.48-195.97[a]
Communications	17.36-34.53	10.03-71.27	16.72-83.67	309.84[b]
Com. Science	17.50-86.04	27.91-61.46	16.78-217.56	35.05[b]
Education	22.28-38.09	37.12-60.04	34.66-76.52	115.03-186.67
Engineering	31.74-49.73	31.57-65.05	77.84-246.59	262.10-500.69[a]
Fine Arts	25.11-51.08	41.50-74.68	112.34-615.05	464.87[b]
For. Languages	19.69-90.70	48.47-153.03	55.95-162.08	252.50[b]
Health Prof.	19.14-59.21	35.03-75.00	47.17-166.05	200.17-520.87
Home Economics	17.87-35.42	27.40-81.93	37.56-439.64	302.17[b]
Letters	19.12-24.39	21.47-50.57	58.74-232.23	132.87-511.94
Lib. Science	- -	24.76-92.15	43.04-133.39	- -
Mathematics	14.51-24.77	27.07-58.49	49.42-105.17	161.65-289.11
Physical Sci.	20.26-31.14	43.94-67.08	24.56-380.47	231.65-326.54[a]
Psycology	8.69-20.23	22.93-36.16	15.17-80.03	48.14-207.30
Pub. Affairs	12.21-31.37	26.30-59.66	43.40-95.92	
Soc. Sciences	14.61-27.10	31.56-47.59	59.13-227.07	196.41-504.95
Inter Disc.	2.41-44.69	63.24-354.05	88.60-202.72[a]	190.94[b]

*Not all institutions have each discipline at each level.

[a]Only two institutions have this discipline at this level.
[b]Only one institution has this discipline at this level.

Source: 1981 Cost Study of the Tennessee Higher Education Commission.

were equal for each level and the grouping of the discipline costs into homogeneous subsets. The F ratios for the test of the hypothesis that mean costs were equal were statistically significant (see Table 5).

Employing Scheffe's method to group the mean costs for the university into homogeneous subsets resulted in the reduction of the 19 disciplines into 10 subsets (with considerable overlap) at Level One, and nine at Level Two (see Table 6). Mean costs appear to be more homogeneous for the universities at Level Two than at Level One. On the other hand, employing the same methodology for costs at the 10 public community colleges resulted in only two subsets (see Table 7). The greater homogenity of costs for the community colleges is the result of greater uniformity of salaries among the disciplines and less variation in class sizes in the community colleges.[20] The finding that the number of homogeneous subsets is substantially below the number of HEGIS disciplines, along with the considerable overlap of the subsets, is strongly suggestive that disciplines can be consolidated so as to simplify the formulas and the attendant "cost finding" procedures. It was pointed out earlier that the number of "disciplines" used in formulas in SREB states ranged from 2 to 30 (again see Table 1).

When the cost rankings by HEGIS disciplines are compared with a workload driven formula, some interesting contrasts develop. For example, the University of Georgia System employs standardized workload

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[20]In an earlier effort in developing a faculty salary model, I found that it was possible to aggregate community college faculty into two "disciplines," the transfer programs and the occupational programs. See Roy L. Lassiter, Jr., "The Development of a Faculty Salary Model for a System of Higher Education," Research in Higher Education, Vol. 18, No. 3, 1983.

Table 6

HOMOGENEOUS SUBSETS OF MEAN INSTRUCTIONAL COSTS FOR NINE PUBLIC UNIVERSITIES IN TENNESSEE, BY HEGIS DISCIPLINE AND LEVEL, 1981*

Level and Subset	HEGIS Discipline and Mean Instructional Cost per Student Credit Hour				
LEVEL ONE					
Subset 1	Psychology $13.91				
2	Mathematics $18.64	Business $19.20			
3	Business $19.20	Soc. Sci. $20.06			
4	Letters $21.50				
5	Comp. Sci. $23.95	Biology $26.27	Comm. $26.35		
6	Biology $26.27	Comm. $26.35	Phys. Sci. $27.87	Pub. Aff. $29.02	
7	Pub. Aff $29.02	Educ. $29.37	Home Ec. $30.81	For. Lang $32.59	Agric $32.79
8	For. Lang. $32.59	Agric. $32.79	Int. Dis. $37.11		
9	Inter Dis. $37.11	Engin. $38.19	Hlth Prof. $42.85		
10	Hlth Prof. $42.85	Fine Art $45.24			
LEVEL TWO					
Subset 1	Business $25.41	Psychology $29.88*			
2	Psychology $29.00	Comm. $34.06	Soc.Sci. $35.02	Math $37.79	
3	Comm. $34.06	Soc.Sci $35.02	Math $37.79	Comp.Sci. $36.16	Letters $38.47
4	Math $37.79	Comp.Sci. $36.16	Letters $38.47	Pub.Affs. $40.75	

Table 6 (continued)

LEVEL TWO					
Subset 5	Letters	Pub.Affs.	Education	Agric.	Home Ec
	$38.47	$40.75	$43.77	$43.85	$44.50
6	Pub.Affs.	Education	Agric.	Home Ec.	Biology
	$40.75	$43.77	$43.85	$44.50	$45.54
7	Education	Agric.	Home Ec.	Biology	Phys.Sci.
	$43.77	$43.85	$44.50	$45.54	$53.85
	Engineer	Hlth Prof.	Lib. Sci.		
	$54.06	$55.06	$55.99		
8	Lib. Sci.	Fine Arts	For. Lang.		
	$55.98	$66.66	$67.93		
9	Interdisc.				
	$93.15				

*Preliminary

Source: Computed from data in the 1981 cost study of the Tennessee Higher Education Commission

Table 7

HOMOGENEOUS SUBSETS OF MEAN INSTRUCTIONAL COSTS FOR TEN PUBLIC COMMUNITY COLLEGES IN TENNESSEE, BY HEGIS DISCIPLINE, 1982*

Subset	HEGIS Discipline and Mean Instructional Cost per Student Credit Hour					
Subset One	Business	Psychology	Soc. Sci.	Math	Letters	Pub.Affs.
	$14.68	$17.20	$19.14	$19.55	$21.61	$23.57
	Lib. Sci.	Interdisc	Biology	Home Ec.	Comm.	Phys.Sci.
	$26.12	$26.68	$27.91	$28.90	$30.27	$30.62
	Education	For Lang.	Engineer			
	$32.18	$34.00	$34.80			
Subset Two	Lib. Sci.	Interdisc.	Biology	Home Ec.	Comm.	Phys.Sci.
	$26.12	$26.68	$27.91	$28.90	$30.27	$30.62
	Education	For Lang.	Engineer	Fine Art	Agric.	
	$32.18	$34.00	$34.80	$43.72	$49.81	

*Preliminary

Source: Computed from data in the 1981 cost study of the Tennessee Higher Education Commission.

measures for groupings of the HEGIS disciplines to generate requests for funds.[21]

When the arrayed costs for HEGIS disciplines in Tennessee are compared with counterpart University of Georgia discipline groupings, it is evident that either: (1) different priorities exist for the two states, or (2) that the institutions in Georgia would use resources differently than that Systems' formula would generate (see Table 8). For example, Business, Mathematics, and Computer Science costs rank in the lower third of the array of mean costs in Tennessee but would rank in either the middle or upper groups in terms of the resources provided by the formula in Georgia. Library Science and Interdisciplinary Studies rank in the highest third of mean costs in Tennessee, but are classified in lower groupings by the Georgia formula.

V

In the introduction to this paper I indicated that components of the economics profession most vitally affected by the funding allocation formulas have devoted relatively little attention to the educational production function and its relationship to the formulas employed to generate resource requirements and/or allocate resources. In part, this paper represents a plea for more efforts by the profession.

Formulas for generating resource requirements and/or allocations of resources are widely used in public higher education, particularly in the SREB states. Although the detailed characteristics of the formulas

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[21] See the footnote to Table 8 for the document from which the University of Georgia System workload resources were obtained and a brief outline of the groupings of disciplines.

Table 8

COMPARISON OF THE RANKINGS OF MEAN INSTRUCTIONAL COST FOR HEGIS DISCIPLINES FOR NINE PUBLIC UNIVERSITIES IN TENNESSEE AND WORKLOAD MEASURES EMPLOYED BY THE UNIVERSITY OF GEORGIA SYSTEM AT LEVELS ONE AND TWO*,+

LEVEL AND GEORGIA AREA	HEGIS Discipline, Cost Per Student Credit Hour, and University of Georgia System Groupings PROGRAM									
Georgia Program Area Level I	I PSYCO (13.93)	II MATH (18.64)	II BUSINESS (19.20)	I SOC SCI (20.06)	I LETTERS (21.50)	III COMP SCI (23.95)	III BIOLOGY (26.27)	II COMM (26.35)	III PHY SCI (27.87)	II PUB AFF (29.02)
	II EDUCA (29.37)	II HOME EC (30.81)	III FOR LANG (32.59)	III AGRIC (32.79)	II INTER DIS (37.11)	III ENGINEER (38.19)	III HLT PROF (42.85)	III FINE ART (45.24)		
Georgia Program Area Level II	II BUSINESS (25.41)	I PSYCHO (29.00)	II COMM (34.06)	I SOC SCI (35.02)	II MATH (35.79)	III COMP SCI (36.17)	I LETTERS (38.47)	II PUB AFF (40.75)	II EDUCA (43.77)	III AGRIC (43.85)
	II HOME EC (45.50)	III BIOLOGY (45.54)	III PHY SCI (53.85)	III ENGINEER (54.06)	III HLTH PRO (55.06)	I LIB SCI (55.99)	III FINE ART (63.66)	III FOR LANG (67.93)	II INTR DISC (93.13)	

*Preliminary

+The program area assignments in order of decreasing faculty "productivity" i.e., higher ratios of faculty positions to student credit hours are: Group I-Law, Letters, Library Science, Psycology, and Social Sciences; Group II-Area Studies, Business, Communications, Education, Home Economics, Mathematics, Public Affairs, and Inter-disciplinary Studies; Group III-Agriculture Architecture, Biological Sciences, Computer Sciences, Engineering, Fine and Applied Arts, Foreign Languages, Health Professions, Physical Science, and Technologies.

Source: Mean Instructional Costs from Table 3. Workload Groupings taken from, Formula for Excellence: Financing Georgia's University System in the 80's. Atlanta: Office of the Governor, Final Report of the Study Committee on Public Higher Education Finance, 1982, p. 23.

vary they are either cost of workload driven. Use of formulas based on historical costs or workload measures introduces a circularity into the process which obscures the impacts of the changing demends of students among the various programs, appropriation and allocation decisions, and inflation.[22] Furthermore, averaging of costs or workloads over a number of institutions which vary significantly in size, complexity, mission, and priorities introduces biases into the resource generation/allocation process which do not reflect economics of scale, joint production, or institutional missions and priorities. In fact, the process insures that some institutions will receive too much for particular programs while others will receive too little for the same programs.

Ideally, formulas would be based on standardized workload measures which reflect the resource requirements for the attainment or maintenance of the level of quality specified in the missions of the institutions. Such a procedure will provide explicit recognition of the impact of appropriations/allocation decisions and inflation on the institutions and programs. While some have feared to submit requests to legislatures which are "ridiculously" high relative to current appropriations, current procedures in some states may lead legislators to the false conclusion that they are maintaining some historically based levels of quality. Allocation decisions among public higher institutions, prisons, K-12 public education, public safety, etc., by legislatures must be based on "full disclosure" of the costs among the competing claims on public resources. Many of these claims are "workload" based, and in the case of the penal systems, the "workloads" have been defined by federal courts.

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[22]On occasion I have pointed out that the historically based formula operates on the implicit assumption that average costs will be infinite for zero enrollments and zero for infinite enrollments.

The HEGIS taxonomics are inappropriate bases for the measurement of costs or workloads. In the first place the taxonomics were designed for other purposes and are inadequately defined to be employed as cost centers. The analysis of the data in the Tennessee Cost Study has demonstrated that much of the differences between mean costs in the HEGIS "disciplines" is not statistically significant. The "disciplines" could be aggregated into three or four groups which would have the advantages of simplifying the formulas and minimizing the impact of changes in costs in a single discipline.

Time, problems with data files, and computer/programming difficulties have precluded inclusion of much of the analysis which I intended to carry out in this paper. However, it is appropriate to state the follow-up analyses which will be taken in the project. Two factor ANOVA (regression approach) will be employed to establish the effects of: (1) level and discipline at Levels One-Four; (2) type of institution and discipline between the universities and community colleges; and (3) type of institution and discipline between the comprehensive and regional universities. The objective is to investigate the appropriateness of a single formula for all three types of institutions, i.e., community colleges, regional universities, and comprehensive universities.

Using modifications of the homogeneous subsets of disciplines established using one-way ANOVA and Scheffe's method total instructional cost functions will be developed for the community colleges at Level One, the universities at the undergraduate, graduate, and all levels using multiple regression techniques in both arithmetic and logarithm form. The cost functions will be tested for linearity.

Selected References

Allen, Richard H. and James R. Topping, eds., Cost Information and Formula Funding: New Approaches. Boulder: National Center for Higher Education Management Systems, 1980.

Breneman, David, The Stability of Faculty Input Coefficient in Linear Workload Models of the University of California. Berkely: Ford Foundation Program for Research in University Administration, 1969.

Brovender, Shlom, "On the Economics of a University: Toward the Determination of Marginal Cost of Teaching Services," Journal of Political Economy, Vol. 82, No. 3, May-June, 1974,pp. 657-664.

Carlson, Daryl E., The Production and Cost Behavior of Higher Education Institutions. Berkeley: Ford Foundation Program for Research in University Administration, 1972.

Caruthers, J. Kent and Melvin Orwig, Budgeting in Higher Education. Boulder: National Center for Higher Education Management Systems, 1979.

Collier, Douglas J., Program Classification Structure. 2nd ed., Boulder: National Center for Higher Education Management Systems, 1978.

Glenny, Lyman A., et. al., State Budgeting for Higher Education: Data Digest. Berkeley: Center for Research and Development in Higher Education, 1975.

Goldberger, Arthur S., Econometric Theory. New York: Wiley, 1964.

Gross, Francis M., "Formula Funding and the Financing of Public Higher Education: Panacea or Nemesis for the 1980s?" The AIR Professional File, No. 3, Fall, 1979.

Guenther, William C., Analysis of Variance. Englewood Cliffs: Prentice-Hall, 1964.

Gulko, Warren W. and K. M. Hussain, A Resource Requirements Prediction Model (RRPM-1)--An Introduction to the Model. Boulder: National Center for Higher Education Management Systems, 1971.

Halstead, D. Kent, Inflation Measures for Schools and Colleges. Washington: U.S. Government Printing Office, 1983.

Huff, Robert A. and Marjorie O. Chandler, A Taxonomy of Instructional Programs in Higher Education. Washington: National Center for Educational Statistics, 1970.

Kershaw, J. A. and A. M. Mood, "Resource Allocation in Higher Education," American Economic Review, May, 1970, pp. 341-346.

Lassiter, Roy L., Jr., Instructional Productivity and the Utilization of Faculty Resources in the State University System of Florida, Gainesville: Institute of Higher Education, 1976.

Lee, Maw L., David W. Stephens, and Richard L. Wallace, "A Conspicuous Production Theory of Resource Allocation in Higher Education," Higher Education, No. 4, 1975, pp. 77-86.

Malitz, Gerald S., A Classification of Instructional Programs. Washington: National Center for Education Statistics, 1981.

Michigan State Department of Education, Formula Funding Mechanisims for State Support of Public Colleges and Universities in Michigan Based on a Study of Funding Mechanisims Across the Nation. Lansing: State Department of Education, 1976.

Millett, John D., The Budget Formula as the Basis for State Appropriations in Higher Education. Washington: Academy for Educational Development, 1974.

National Association of College and University Business Offices, Costing for Policy Analysis. Boulder: National Center for Higher Education Management Systems, 1980.

Spence, David S., Formula Funding in the SREB States. Atlanta: Southern Regional Education Board, 1978.

State of Georgia, Formula for Excellence: Financing Georgia's University System in the '80s. Atlanta: Office of the Governor, 1982.

State University System of Florida, Educational and General Budget Allocation, 1982-83. Tallahassee: Office of the Board of Regents, 1982.

Toombs, William, Productivity: The Burden of Success. Washington: American Association for Higher Education, 1973.

Witmer, D. R., "Cost Studies in Higher Education," Review of Educational Research, Vol. 42, No. 1, pp. 99-127.